BOOK REVIEWS

Roger Jean, *Phytomathématique* (in French), Les Presses de l'Université du Québec, Montreal, 1978 +267 pp., bibliogr., no index.

This beautifully written little book is concerned primarily with mathematical analogies to morphological growth in vascular plants. Anyone who has looked closely at plants has seen the wonderful variety of shapes and forms that they exhibit. Some of us have also been tantalized by the suggestions of regularity and pattern that arise from the midst of this variety in growing plants. In this book, Roger Jean has brought together much of what has been written to describe in mathematical terms the regularities and patterns of plant form and growth.

But this book is far more than a review. Jean has thoroughly reorganized the ideas of these writers: abandoning ideas that are wrong; correcting numerous mathematical errors; rejecting formalisms that are unproductive; simplifying notation; and providing a unified expository style that enables his readers to share his own understanding of these mathematical analogies to plant growth and form with a maximum of ease.

The mathematical results presented are often quite sophisticated, yet the exposition is always extremely thorough and elementary, providing good access to the concepts. Anyone with two years of college math and an interest in the subject can read and enjoy this book. For the delight of those who do not read French, it should be translated into English.

The book begins with a discussion of phyllotaxy, the arrangement of leaves, buds, scales, etc. around the stem. This includes an examination of generative spirals in cylinders; spirals more generally; the relation between Fibonacci numbers and spirals; and finally a discussion of theories to explain the commonness of the Fibonacci angle between successive plant parts.

The next section concerns morphogenesis. Here considerations are made of differing growth rates and allometry. The early work of Thompson and Grandi is applied to embryogenesis. Considerations of entropy, optimization, and stability are briefly reviewed.

In the third section, models of plant growth are presented. The ideas of Holland relating to cell space are presented. McCulloch's growth algorithm leads back to a new consideration of phyllotaxy, which, following the early ideas of Church, embraces the recent work of Mathai and Davis. Relational trees and the languages of Lindenmayer are shown to be applicable. Growth operators expressed in matrix notation are then used to state some interesting relationships involving the Fibonacci angle and spectral theory. Finally, a mathematical

system for description of plant growth is proposed. Its properties are described in very general terms, and then some axioms and principles are given. Some basic consequences are derived and interpreted.

As Jean himself suggest, the Fibonacci angle is a mysterious number embracing a basic principle of life. Certainly a reverence for nature permeates his book.

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